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THE CHALLENGE OF THE SPACE AGE

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President Fawcett, Judge Gorman, Senator Bricker, members of the faculty, members of the graduating class, and friends:

We stand at a moment in time called the present. It divides all time into two parts, a past and a future. Looking back to the past we have rather complete accounts of man's immediate history but the farther back we go the less we know, and our knowledge is dim indeed of man's earliest beginnings on this planet.

From the most recent evidence available many scientists believe that the earth is about five billion years old, while man as a distinct creature -- that is, the species homo sapiens -- is about one million years old. Compared to billions of years, a million years is but a little while ago and to an astronomer it is but a moment. As we are gathered here this morning there is in the sky almost directly overhead a celestial radio source called Cygnus A. It is a very strong radio source and one which we have observed and studied innumerable times at our Radio Observatory here at The Ohio State University. Yet it is so far away that it takes the radio waves, traveling nearly 700 million miles per hour, about 200 million years to reach us. Thus, the radio waves from this distant object which are falling on us at this moment are waves which started on their journey 200 million years ago. At that time dinosaurs were roaming the earth, and man's emergence was still 199 million years in the future.

From a slow early development man's progress and accomplishments have been at an increasingly rapid rate. In this connection it is instructive to recall man's history on an accelerated time scale. Thus, let us say that the earth, instead of being five billion years old, is one year old. Then on such a time scale man has been on the earth for only the last two hours; the Pharaohs of ancient Egypt reigned 20 seconds ago; the United States gained its independence one second ago; and the airplane, radio, and automobile were invented about 1/4 of a second ago.

Man's history is one of accelerating development. It was a million years from man's first faltering, upright steps to the Wright Brother's first flight at Kitty Hawk. But now 57 years later we stand on the threshold of man's first flights into space. Although it took man a million years to master the earth, he mastered the air in less than 60 years and he now looks to the conquest of space.

The decade of the 1960's, which we have entered, has been aptly named the space age. Whereas man's earlier development is divided into eons or milleniums, the rapid acceleration in his progress means that a decade now may witness more development than centuries did a short while ago. You have the unique honor and also the great challenge of being the first class to graduate from The Ohio State University in this new decade of the space age.

Let us consider some of the things that may be accomplished in this decade. Man may construct manned artificial satellites of the earth.

He may explore some of our nearest neighbors in space, the moon, and the planets Mars and Venus; and if conditions are not too forbidding, may even begin their colonization. In later decades his personal exploration will turn to the more remote parts of the solar system and even to stars and planetary systems that lie far outside our solar system. Man's flights into space will open a frontier which is infinite in extent.

In thinking about outer space, space exploration, and space stations, it is worth noting, as Professor Fred Hitchcock of our Medical College points out, that in a very real sense we now inhabit a space station which we call the planet earth. It is a nearly spherical space station about 8,000 miles in diameter which revolves around a star at a distance of nearly 100 million miles. This star, which we call the sun, furnishes the light and heat for our space station while our space station's gravitational field holds a blanket of air or atmosphere which we can breathe and which protects us from the x-rays and other radiations which impinge from without. Our space station is self-sufficient, and the plants and animals which have evolved upon its surface have adapted themselves to its environment. Thus, in leaving the earth man will be trading one space station in whose environment he is secure for other space stations, where he will, in perhaps all cases, need to provide his own environment.

Why should man venture from the earth, and what of worth will he find? If there is anything which distinguishes man from other animals, it is his curiosity about the universe and the laws which govern it. It is inherent in man's nature that he will go on observing, exploring, and

discovering into the remotest future. It is inevitable that there will be discoveries of vast consequence; but what these are, we do not now know and may not even remotely suspect.

The situation which faces you and faces us all as we enter the new space age is a million times more significant to man and his future than that on the eve of Columbus's voyages 468 years ago. The challenge before us is the greatest in man's history. It will require all the imagination, flexibility, and daring which you can muster to meet the challenge. It will require dedication and diligence but the possibilities are limitless. Although man now has at his disposal frightening powers of self-destruction which stagger the imagination, we would be pessimists indeed to believe that having progressed thus far man's progress will stop now. We should believe that the greatest discoveries are yet to be made, the greatest inventions yet to come, and I don't mean just in outer space. There are new frontiers in inner space, the exploration of the atom and of nuclear power and its limitless possibilities. There are frontiers in medicine, agriculture, and in the arts. But the greatest frontier of all lies in man himself and his capacity to develop.

Let us not discount the future. We should believe that tomorrow may bring greater composers, statesmen, and scientists than any of the past. For all that we know this graduating class of 1960 may have within its ranks a future Mozart, a new Jefferson, or another Einstein. If the human race is to progress, we must believe that such persons will emerge and we must provide the opportunity and environment for them to develop.

But to meet the challenge of the space age will take more than wishing, it will require hard work; it will take more than dollars, it will require a keen realization of what is important and what is worthwhile. We need less arrogance and more humility and dedication. We need less emphasis on a high standard of living and more on a high standard of thinking and doing.

The United States is the best-fed and best-clothed nation in the world with more luxuries, more wealth than any other nation. By comparison, Russia's 200 millions are poorly fed, poorly clothed, and with few if any luxuries. Yet Russia is turning out twice as many scientists and engineers as we do, and is moving ahead in science at a prodigious rate. The Soviets appear to have as a national policy the objective of controlling nature, and they recognize the vital fact that to control nature you must first understand it. And so they are pushing ahead at top speed in all areas of basic research. Their scientists are working hard. Their students are working hard. As one Russion visitor wryly remarked when asked if there were many failures among their students, "They either pass or they die trying."

According to Dr. Allen Hynek, formerly of Ohio State, we cannot buy success in science merely by pouring more money into hardware. We must work hard at fundamentals. He reports that the U.S.S.R. is full of institutes for fundamental studies of all kinds, including oceanography and meteorology. He feels that if and when control of the weather comes, it may be dominated by the Russians because they were first to learn all about it.

In Russia scientists and teachers are highly respected and receive the highest salaries. Is it any wonder then that their best talent is attracted to these areas? Here at home many engineering graduates have the pick of many jobs at salaries higher than those of the university professors who taught them. This is but one of the reasons that it is terribly difficult to keep competent teachers in our schools and universities. And this is at a time when the demand for larger numbers of better trained graduates is higher than ever before. Without good teachers a university's buildings are just so many bricks and its laboratory facilities so much hardware, glass, and iron.

Thus, the challenge of the space age is double-barrelled. One barrel is the challenge of the space frontier. The other barrel is Russia. And unfortunately it is mainly the Russian barrel which is goading us into action. Russia poses a terribly grave threat militarily, scientifically, economically, and politically. We should certainly do something about these threats. But this is not enough because in merely countering these threats it is really Russia which is setting the pace. We should have long range objectives which are worthwhile and durable in their own right. Dr. James A. Van Allen of the State University of Iowa puts it this way. He feels that the most durable objective the United States could have as a matter of national policy is the support of basic research stemming from curiosity in all fields of science and human endeavor. Only when our government recognizes this fact can we expect real progress instead of the catch-up-with-the-Russians kind. An

encouraging first step in this direction was announced by President Eisenhower last month with his appointment of a National Goals Commission to recommend basic and far-reaching national policies for the next decade or more. This commission, according to the President, has the opportunity to sound a call for greatness to a resolute people in the best tradition of our founding fathers. It is to be hoped that a program with positive and enduring objectives may be forthcoming.

But it should not be necessary for me to remind you that in a democracy each one of us has the opportunity and responsibility to develop his own best talents and apply them to the utmost of his ability. You, as graduates of one of our great universities, have a unique opportunity to meet the challenge of the space age. But your growth and development cannot stop with the receipt of a college degree. This marks the culmination of only a formal and intensive phase of your education, and to keep pace with the rapid developments of the future you will need to continue your education informally through observation, reading, and self-study. You will have to run to merely stand still. I like to think of this perpetual self-education as an "operation bootstrap" by which each of us continually lifts himself in knowledge and understanding.

Our leaders can formulate policies to guide our efforts, but what this nation will be 10, 50, or 100 years from now will depend in the most vital way on the contribution each one of us makes. The overall achievements of any nation are the sum total of the accomplishments, both good and bad, of each individual citizen. We should remember that any task worth doing at all is worth our best effort.

I should like to mention now several matters which we as individuals and as a nation must do something about if we are to meet the challenge of the space age.

First, as individuals and as a nation, we desperately need to do all we can to make teaching a more attractive profession. This means higher salaries, much higher salaries. But even more important it means more understanding and respect for the profession and a recognition of good teaching wherever it is found. The first Alumni Awards for Distinguished Teaching conferred two weeks ago on five Ohio State University professors are progressive moves toward such recognition. We need more incentives and rewards of this kind for outstanding work not only in teaching but in many other fields. We may have no royal titles or knighthoods to confer, but we can certainly reward excellence of achievement in other ways.

Second, we need to make careers in scientific research and in engineering more attractive. This is to a considerable extent a function of our educational system. The science and engineering are necessary for survival, but we need an educational program that is also strong in the humanities if we are to have a culture worth surviving for. It is not that we need science in place of the humanities, it is that we need both science and the humanities each having a proper respect and appreciation for the other. In fact I feel that the new demands may fall even heavier

on the humanities. As Professor Charles Frankel of Columbia University points out,

> "The scientific imagination of the twentieth century has shown remarkable flexibility and daring. There is no reason in the nature of things why our social imagination cannot show some of the same qualities, or why it cannot escape as modern science has from the backyard of its old commonplaces and dogmas. If it did, its achievements could be even greater than the shooting of satellites into the sky."

This is the challenge to the humanities, and please note that I have just been quoting, not a scientist or engineer, but a professor of philosophy.

Third, we should give more recognition to the important place which women have in the national scene. Not only are they the anchors of our homes and the mothers of our next generation, but they have mental abilities which we as a nation are utilizing only to a very small extent. It has been said, and rightly so, that the woman brain power of the United States is our greatest untapped natural resource. There are enormous opportunities for women in science, engineering, and medicine, to mention only a few areas.

Fourth, we should, as a national objective, give vastly greater support to basic or creative research. This is the pioneering or foundation research on which our whole scientific structure stands. It is the research, as President Eisenhower has said, which "unlocks the secrets of nature and prepares the way for such great breakthroughs as atomic fission, electronics, and antibiotics . . ." We must know

what binds an atom, what makes a virus multiply, where cosmic rays come from. If man no longer searches for knowledge and truth for its own sake, he is no longer man.

Our knowledge is like the area inside a circle and the unknown like the area outside. The more we learn the greater the circle becomes, but so also does the edge of the circle or frontier of the unknown. Thus, the conquest of nature and of the unknown constitutes an endless frontier that will challenge man as long as he is capable of thinking and wondering.

The need for creative research and creative thought in all fields is abundantly clear not only for national survival but for the survival of the human race. As the famous British astrophysicist Fred Hoyle puts it, "The nation that neglects creative thought today will assuredly have its nose ground into the dust of tomorrow."

And where better can this creative effort be accomplished than in the universities of our land? It is the universities' task to push back the frontiers of knowledge and to teach the new facts and discoveries along with the old to increasingly larger numbers of students. Our universities are one of our very greatest resources for the future, and their support should receive the highest priority.

It is not security which makes a nation great, it is response to challenge. But as physicist and Dean Emeritus Alpheus Smith of our Graduate School, one of Ohio State's greatest and most dedicated scholars, has warned, unless we have high on our list the preservation of character and of the freedom to inquire we shall not survive at all.

In our free society the problem is one on which everyone can and must help. If you, the first graduating class in the new space age of the 1960's, and we all face up to the challenge, there is no limit with God's help to what we can do.